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Bryant(10) Pub. No.: **US 2004/0065308 A1**(43) Pub. Date: **Apr. 8, 2004**(54) **INTERNAL COMBUSTION ENGINE AND WORKING CYCLE**(76) Inventor: **Clyde C. Bryant, Alpharetta, GA (US)**

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ATLANTA, GA 30357-0037 (US)(21) Appl. No.: **10/679,914**(22) Filed: **Oct. 6, 2003****Related U.S. Application Data**

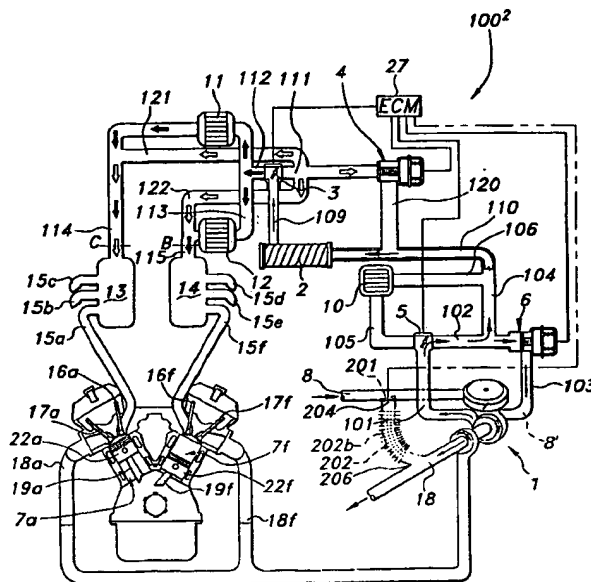
(63) Continuation of application No. 09/632,739, filed on Aug. 4, 2000, which is a continuation of application No. 08/863,103, filed on May 23, 1997, now Pat. No. 6,279,550, and which is a continuation-in-part of application No. 08/841,488, filed on Apr. 23, 1997, now abandoned.

(60) Provisional application No. 60/040,630, filed on Mar. 7, 1997. Provisional application No. 60/029,260, filed on Oct. 25, 1996. Provisional application No. 60/023,460, filed on Aug. 6, 1996. Provisional application No. 60/022,102, filed on Jul. 17, 1996.

Publication Classification(51) Int. Cl.⁷ **F02B 33/00**(52) U.S. Cl. **123/562; 123/563**(57) **ABSTRACT**

The invention is concerned with a method of deriving mechanical work from a combustion gas in internal com-

bustion engines and reciprocating internal combustion engines for carrying out the method. The invention includes methods and apparatuses for managing combustion charge densities, temperatures, pressures and turbulence in order to produce a true mastery within the power cylinder in order to increase fuel economy, power, and torque while minimizing polluting emissions. In its preferred embodiments, the method includes the steps of (i) producing an air charge, (ii) controlling the temperature, density and pressure of the air charge, (iii) transferring the air charge to a power cylinder of the engine such that an air charge having a weight and density selected from a range of weight and density levels ranging from below atmospheric weight and density to heavier-than-atmospheric weight and density is introduced into the power cylinder, and (iv) then compressing the air charge at a lower-than-normal compression ratio (v) causing a pre-determined quantity of charge-air and fuel to produce a combustible mixture, (vi) causing the mixture to be ignited within the power cylinder, and (vii) allowing the combustion gas to expand against a piston operable in the power cylinders with the expansion ratio of the power cylinders being substantially greater than the compression ratio of the power cylinders of the engine. In addition to other advantages, the invented method is capable of producing mean effective cylinder pressures ranging from lower-than-normal to higher-than-normal. In the preferred embodiments, the mean effective cylinder pressure is selectively variable (and selectively varied) throughout the mentioned range during the operation of the engine. In an alternate embodiment related to constant speed-constant load operation, the mean effective cylinder pressure is selected from the range and the engine is configured, in accordance with the present invention, such that the mean effective cylinder pressure range is limited, being varied only in the amount required for producing the power, torque and speed of the duty cycle for which the engine is designed.



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